

This listing of claims will replace all prior versions, listings, of claims in the application:

**Listing of Claims:**

1. (Currently amended) A bio-fuel cell system for concurrent production of electrical power and single-cell protein, and consumption of carbon dioxide (CO<sub>2</sub>), comprising:
  - a cathode compartment containing a cathode electrode with an aqueous solution containing ferric ions (Fe<sup>3+</sup>) being circulated into said cathode compartment with a reaction at the cathode electrode being reduction of ferric ions at the cathode electrode in a reaction given by  $4\text{Fe}^{3+} + 4\text{e}^- = 4\text{Fe}^{2+}$ ;
  - an anode compartment containing an anode electrode;
  - ~~a first means for injecting with~~ a fuel having a hydrogen constituent ~~being pumped~~ directly into said anode compartment, said anode compartment being separated from said cathode compartment by a membrane permeable to protons, a reaction at the anode electrode being electrochemical oxidation of at least the hydrogen constituent of the fuel to produce electrons (e<sup>-</sup>) and protons (H<sup>+</sup>), wherein protons (H<sup>+</sup>) formed by the oxidation of hydrogen cross the proton exchange membrane into the cathode compartment; and
  - a bioreactor containing chemolithotrophic microorganisms and dissolved nutrients to facilitate growth of the chemolithotrophic microorganisms, ~~a pump for pumping a second means for injecting~~ a fluid containing oxygen (O<sub>2</sub>) and atmospheric carbon dioxide into the bioreactor, the bioreactor being in flow communication with the cathode compartment so that an aqueous solution containing ferrous ions (Fe<sup>2+</sup>) and protons (H<sup>+</sup>) is circulated from the cathode compartment to the bioreactor where the ferrous ions (Fe<sup>2+</sup>) are oxidized by the chemolithotrophic microorganisms to ferric ions (Fe<sup>3+</sup>) in an aerobic oxidation reaction given by  $4\text{Fe}^{2+} + 4\text{H}^+ + \text{O}_2 = 4\text{Fe}^{3+} + 2\text{H}_2\text{O}$ , and wherein single-cell protein production and carbon dioxide consumption responsively occurs due to fixation of the carbon dioxide (CO<sub>2</sub>) by the chemolithotrophic microorganisms in the presence of the dissolved nutrient salts and ferrous ions;

~~means for circulating a pump for pumping~~ a fluid containing said ferric ions ( $\text{Fe}^{3+}$ ) into said cathode compartment from said bioreactor; and

wherein electrical power is obtained by making electrical connection between a load and the anode and cathode electrodes.

2. (original) The bio-fuel cell system according to claim 1 wherein the membrane permeable to protons is a proton exchange membrane.

3. (original) The bio-fuel cell system according to claim 1 wherein the membrane permeable to protons is made of a substantially inert material having pores extending therethrough less than about 10 micrometers in diameter.

4. (Cancelled)

5. (Previously presented) The bio-fuel cell system according to claim 1 wherein the dissolved nutrients is one or more of ammonium sulfate, potassium phosphate, magnesium sulfate, potassium chloride, calcium nitrate, calcium chloride and sulfuric acid.

6. (previously presented) The bio-fuel cell system according to claim 1, wherein the fuel having a hydrogen constituent is selected from the group consisting of hydrogen gas, methanol, methane and ethanol.

7. (previously presented) The bio-fuel cell system according to claim 1, wherein the fuel having a hydrogen constituent is hydrogen gas ( $\text{H}_2$ ), and wherein the electrochemical oxidation reaction is oxidation of hydrogen at the anode electrode in a reaction given by  $2\text{H}_2 = 4\text{H}^+ + 4\text{e}^-$ , and so that an overall bio-fuel cell reaction is given by  $2\text{H}_2 + \text{O}_2 = 2\text{H}_2\text{O}$ .

8. (previously presented) The bio-fuel cell system according to claim 1, wherein the chemolithotrophic microorganisms are *Acidithiobacillus ferrooxidans*.

9. (previously presented) The bio-fuel cell system according to claim 1, wherein the chemolithotrophic microorganisms are selected from the group consisting of *Leptospirillum ferrooxidans*, *Acidimicrobium*, *Alicyclobacillus*, and *Sulfobacillus*.
10. (previously presented) The bio-fuel cell system according to claim 1, wherein the cathode electrode is made from a chemically inert electrically conducting material.
11. (original) The bio-fuel cell system according to claim 10 wherein the cathode electrode includes a layer of a porous material selected from the group consisting of carbon, nickel and stainless steel.
12. (original) The bio-fuel cell system according to claim 10 wherein the cathode electrode includes a solid plate of a material selected from the group consisting of carbon, nickel and stainless steel.
13. (previously presented) The bio-fuel cell system according to claim 10, wherein the cathode electrode includes a catalyst.
14. (original) The bio-fuel cell system according to claim 13 wherein the catalyst is one of gold, platinum, palladium and lead.
15. (previously presented) The bio-fuel cell system according to claim 1, wherein the bioreactor is a vessel in flow communication with the cathode compartment and enclosing the chemolithotrophic microorganisms, and wherein the aqueous solution containing ferric ions ( $\text{Fe}^{3+}$ ) is circulated into said cathode compartment, including a pump for circulating the aqueous solution containing ferrous ions ( $\text{Fe}^{2+}$ ) and protons ( $\text{H}^+$ ) produced in the cathode compartment between the cathode compartment and the bioreactor, where the ferrous ions ( $\text{Fe}^{2+}$ ) are oxidized by the chemolithotrophic microorganisms to ferric ions ( $\text{Fe}^{3+}$ ) in said aerobic oxidation reaction, and wherein the ferric ions are recirculated back to the cathode compartment.

16. (Cancelled)
17. (Currently amended) The bio-fuel cell system according to claim 16 1 including means for applying and controlling a voltage on the cathode electrode for controlling a ratio of electrical production to single-cell protein production by varying microbial cultivation parameters.
18. (Currently amended) The bio-fuel cell system according to claim 16 1 including means for controlling a ratio of  $\text{Fe}^{2+}/\text{Fe}^{3+}$  concentrations for varying microbial cultivation parameters in order to control a ratio of electrical production to single-cell protein production.
19. (Previously presented) The bio-fuel cell system according to claim 4 including means for controlling concentrations of the dissolved nutrients concentrations for varying microbial cultivation parameters in order to control a ratio of electrical production to single-cell protein production.